

Claims:

What is claimed is:

- 1 1. A method for thawing frozen biopharmaceutical solutions comprising:
2 providing a container that contains a biopharmaceutical solution, at least a
3 portion of the biopharmaceutical solution being frozen,
4 providing an oscillatory driver coupled to the biopharmaceutical solution;
5 providing a heat flux into the biopharmaceutical solution; and
6 inducing oscillatory motion of the biopharmaceutical solution via oscillatory
7 motion of the oscillatory driver to accelerate thawing, compared to motionless thawing,
8 of the portion of the biopharmaceutical solution that is frozen.
- 1 2. The method of claim 1, wherein the oscillatory motion of the oscillatory driver is
2 harmonic motion.
- 1 3. The method of claim 1, wherein the oscillatory motion of the oscillatory driver is
2 disharmonic motion.
- 1 4. The method of claim 1, wherein an amplitude of the oscillatory motion of the
2 oscillatory driver ranges from about 0.0002 mm to about 10,000 mm.
- 1 5. The method of claim 2, wherein an amplitude of the oscillatory motion of the
2 oscillatory driver ranges from about more preferably from about 0.015 mm to about 350
3 mm.
- 1 6. The method of claim 1, wherein a frequency of the oscillatory motion of the
2 oscillatory driver ranges from about 0.01 Hz to about 20 GHz.
- 1 7. The method of claim 4, wherein a frequency of the oscillatory motion of the
2 oscillatory driver ranges from about 0.1 Hz to about 1 kHz.

1 8. The method of claim 5, wherein a frequency of the oscillatory motion of the
2 oscillatory driver ranges from about 0.4 Hz to about 40 Hz.

1 9. The method of claim 1, wherein the oscillatory motion of the oscillatory driver is
2 induced by inducing oscillatory motion of the container.

1 10. The method of claim 1, wherein the oscillatory motion of the oscillatory driver is
2 induced by inducing oscillatory motion of the portion of the biopharmaceutical solution
3 that is frozen.

1 11. The method of claim 1, wherein the oscillatory motion of the oscillatory driver is
2 induced by inducing oscillatory motion of an unfrozen portion of the biopharmaceutical
3 solution.

1 12. A device for accelerated thawing of a biopharmaceutical solution comprising
2 a container configured to contain the biopharmaceutical solution, wherein at least
3 a portion of the biopharmaceutical solution is frozen;

4 a heating element, coupled to the container, that provides heat flux into the
5 container; and

6 an oscillatory driver capable of being coupled to the biopharmaceutical solution,
7 for inducing oscillatory motion of the biopharmaceutical solution to accelerate thawing,
8 compared to motionless thawing, of the portion of the biopharmaceutical solution that is
9 frozen.

1 13. The device of claim 12, wherein the container comprises a thermal jacket.

1 14. The device of claim 12, wherein the container comprises an agitator.

1 15. The device of claim 12, wherein the oscillatory driver is mechanically coupled to
2 the container.

1 16. The device of claim 12, wherein the oscillatory driver is magnetically coupled to
2 the container.

1 17. The device of claim 12, wherein the oscillatory driver is coupled to an internal
2 structure, and the internal structure is located internally to the container.

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